

COPD

Chronic Obstructive Lung Disease



What is COPD?

- A set of lung diseases that limit air flow and is **not fully reversible**.
 - COPD patients report they are “hungry” for air
 - **Usually progressive** and is associated with inflammation of the lungs as they respond to noxious particles or gases
 - **Potentially preventable** with proper precautions and avoidance of precipitating factors
 - Symptomatic **treatment is available**

What can cause COPD?

- Smoking is the primary risk factor
 - Long-term smoking is responsible for 80-90 % of cases
 - Smoker, compared to non-smoker, is 10 times more likely to die of COPD
- Prolonged exposures to harmful particles and gases from:
 - Second-hand smoke,
 - Industrial smoke,
 - Chemical gases, vapors, mists & fumes
 - Dusts from grains, minerals & other materials

Two Major Causes of COPD

- Chronic Bronchitis is characterized by
 - Chronic inflammation and excess mucus production
 - Presence of chronic productive cough
- Emphysema is characterized by
 - Damage to the small, sac-like units of the lung that deliver oxygen into the lung and remove the carbon dioxide
 - Chronic cough

*Source: Braman, S. Update on the ATS Guidelines for COPD. Medscape Pulmonary Medicine. 2005;9(1):1.

Primary Symptoms

- Chronic Bronchitis
 - Chronic cough
 - Shortness of breath
 - Increased mucus
 - Frequent clearing of throat
- Emphysema
 - Chronic cough
 - Shortness of breath
 - Limited activity level

Epidemiology (1)

- COPD is a leading cause of morbidity and mortality worldwide, and results in an economic and social burden that is both substantial and increasing.
- Prevalence and morbidity data greatly underestimate the total burden of COPD because the disease is usually not diagnosed until it is clinically apparent and moderately advanced.

Epidemiology (2)

- COPD is the fourth leading cause of death in the USA and Europe, and COPD mortality in females has more than doubled over the last 20 years.

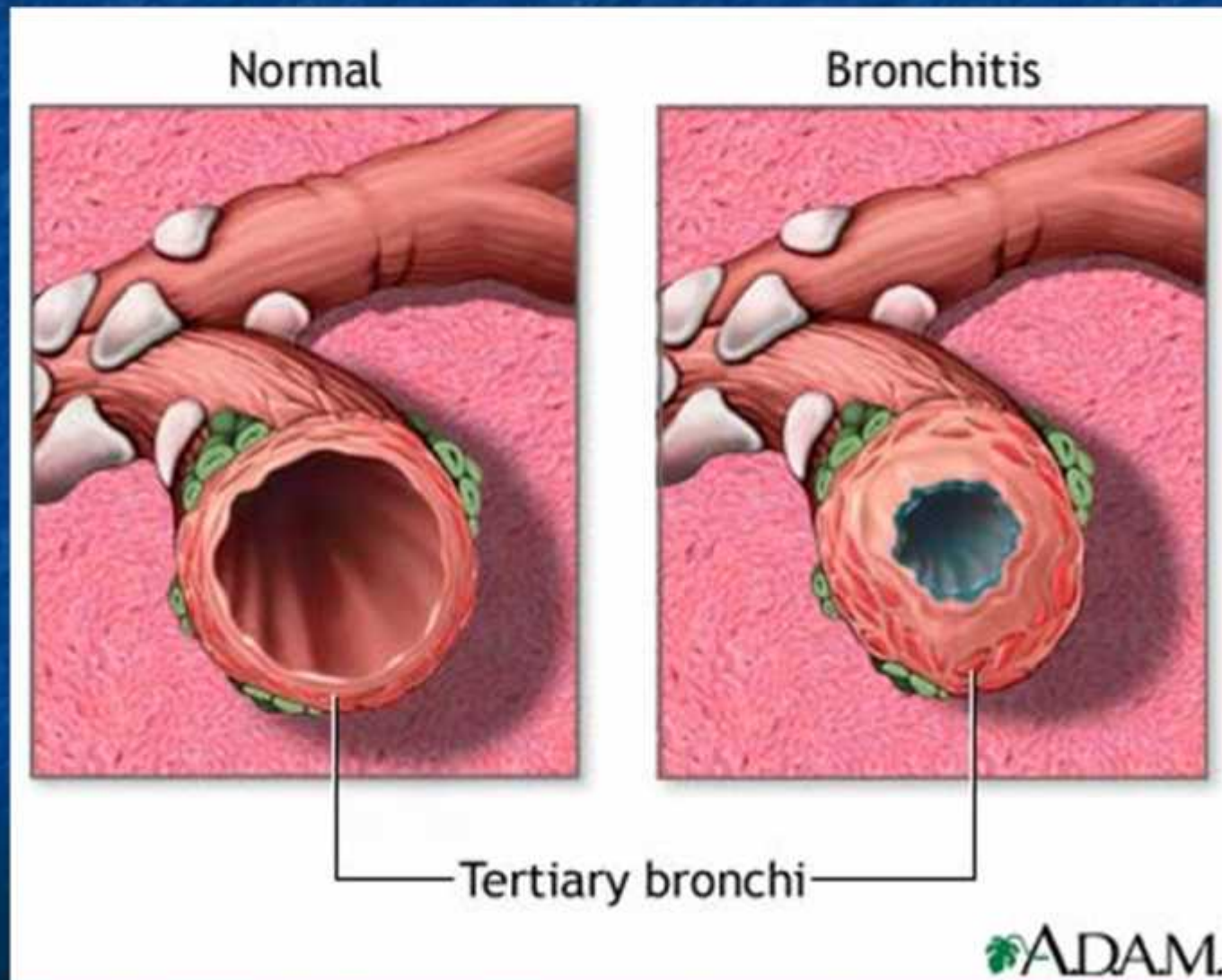
Leading causes of death in the USA, 1998	Number
Heart disease	724,269
Cancer	538,947
Cerebrovascular disease (stroke)	158,060
Respiratory diseases (COPD)	114,381
Accidents	94,828
Pneumonia and influenza	93,207
Diabetes	64,574
Suicide	29,264
Nephritis	26,265
Chronic liver disease	24,936
All other causes of death	469,314

Epidemiology (3)

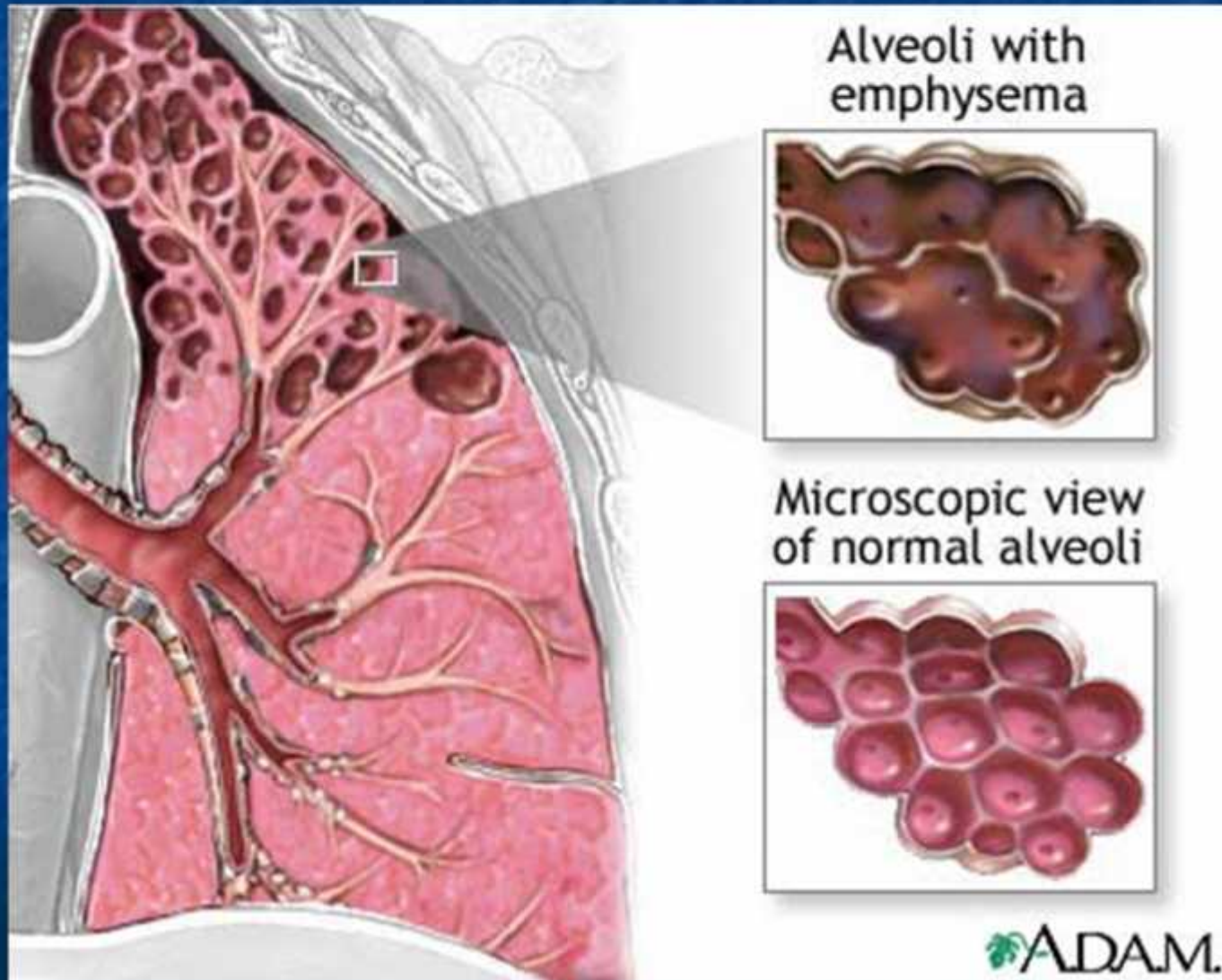
- COPD is a more costly disease than asthma and, depending on country, 50–75% of the costs are for services associated with exacerbations.
- Tobacco smoke is by far the most important risk factor for COPD worldwide.
- Other important risk factors are:

Host factors	Exposures
Genetic factors Sex Airway hyperreactivity, IgE and asthma	Smoking Socio-economic status Occupation Environmental pollution Perinatal events and childhood illness Recurrent bronchopulmonary infections Diet

Normal versus Diseased Bronchi



Emphysema



Evaluation

Medical History

- Allergies
- Sinus problems
- Other respiratory disease
- Risk factors
- Exposures (occupational and environmental)
- Family history
- Co-morbidities that may affect activity
- Medications
- Prior hospitalizations or evaluation to date

Global Initiative for Chronic Obstructive Lung Disease (GOLD), 2009

Evaluations

- Vital Signs
 - Respiratory rate, pattern, effort
 - Pulse oximetry
- Extremities
 - Inspection for cyanosis
- Chest
 - Inspection to assess AP diameter (barrel chest)
 - Palpation and percussion of chest
- Lungs
 - Auscultation for wheezing, crackles, and/or decreased breath sounds

Chronic Obstructive Pulmonary Disease (COPD)



Chest x-ray showing hyperexpanded lungs in heavy smoker with severe emphysema.

Evaluation

Spirometry

- Gold standard for diagnosis
- Standard to establish severity and stage
- Perform both pre- and post-bronchodilator
 - Irreversible airflow limitation is the hallmark of COPD

Global Initiative for Chronic Obstructive Lung Disease (GOLD), 2009

Diagnosis of COPD (1)

- **Diagnosis of COPD** should be considered in any patient who has the following:
 - symptoms of cough
 - sputum production
 - dyspnoea
 - history of exposure to risk factors for the disease
- **Spirometry** should be obtained in all persons with the following history:
 - exposure to cigarettes and/or environmental or occupational pollutants
 - family history of chronic respiratory illness
 - presence of cough, sputum production or dyspnoea

Diagnosis of COPD (2)

Spirometry

- Spirometric classification of COPD:
 - Post-bronchodilator FEV1/forced vital capacity <0.7 confirms the presence of airflow limitation that is not fully reversible.

Severity	Postbronchodilator FEV1/FVC	FEV1 % pred
At risk Patients who: <ul style="list-style-type: none">■ smoke or have exposure to pollutants■ have cough, sputum or dyspnoea■ have family history of respiratory disease	>0.7	≥ 80
Mild COPD	≤ 0.7	≥ 80
Moderate COPD	≤ 0.7	50–80
Severe COPD	≤ 0.7	30–50
Very severe COPD	≤ 0.7	<30

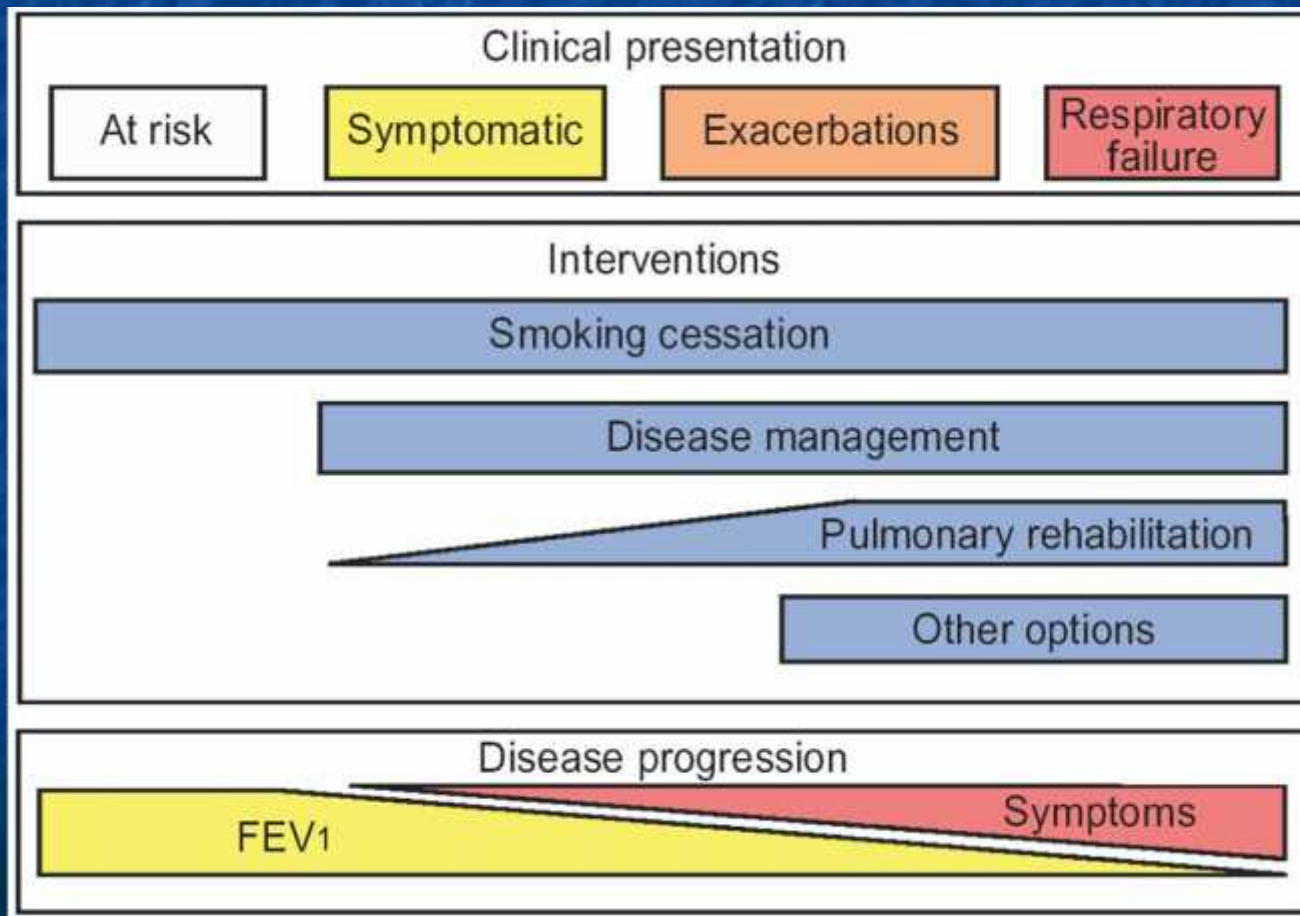
Diagnosis of COPD (3)

BMI and dyspnoea

- Body Mass Index (BMI) and dyspnoea have proved useful in predicting outcomes such as survival, and should thus be evaluated in all patients.
 - BMI values $< 21 \text{ kg}\cdot\text{m}^{-2}$ are associated with increased mortality.
 - Functional dyspnoea can be assessed by the Medical Research Council dyspnoea scale:

0	Not troubled with breathlessness except with strenuous exercise.
1	Troubled by shortness of breath when hurrying or walking up a slight hill.
2	Walks slower than people of the same age due to breathlessness or has to stop for breath when walking at own pace on the level.
3	Stops for breath after walking about 100 m or after a few minutes on the level.
4	Too breathless to leave the house or breathless when dressing or undressing.

Diagnosis of COPD (4)



Diagnostic Criteria

Key Indicators

- Dyspnea
 - Progressive, usually worse with exercise, persistent, described as increased effort to breathe
- Chronic cough
 - May be intermittent, may be nonproductive
- Chronic sputum production
 - Any pattern
- History of exposure to risk factors
 - Tobacco smoke, occupational dust, chemicals, fumes or smoke from cooking or heating fuels

Global Initiative for Chronic Obstructive Lung Disease (GOLD), 2009

Ways to prevent or slow the progression of COPD

- Stop smoking, if you smoke, to prevent further damage to your body
 - Smoking cessation is critical for all severities of COPD
- Avoid or protect yourself from exposures to
 - Second-hand smoke
and
 - Other substances such as chemical vapors, fumes, mists, dusts, and diesel exhaust fumes that irritate your lungs

How is COPD Treated?

- COPD can be managed, but not cured
- Treatment is different for each individual and is based on severity of the symptoms
- Early diagnosis and treatment can
 - Slow progress of the disease
 - Relieve symptoms
 - Improve an individual's ability to stay active
 - Prevent and treat complications
 - Improve quality of life

What medications are used to treat symptoms?

- Bronchodilators –
 - Relaxes muscles around airways
- Steroids
 - Reduces inflammation
- Oxygen therapy
 - Helps with shortness of breath

What medications are used to prevent complications?

- Annual flu vaccine
 - Reduces risk of flu and its complications
- Pneumonia vaccine
 - Reduces risk of common cause of pneumonia

Differential Diagnoses

Pulmonary

- Asthma
- Bronchogenic carcinoma
- Bronchiectasis
- Tuberculosis
- Cystic fibrosis
- Interstitial lung disease
- Bronchiolitis obliterans
- Alpha-1 antitrypsin deficiency
- Pleural effusion
- Pulmonary edema
- Recurrent aspiration
- Tracheobronchomalacia
- Recurrent pulmonary emboli
- Foreign body

Non-pulmonary

- Congestive Heart Failure
- Hyperventilation syndrome/panic attacks
- Vocal cord dysfunction
- Obstructive sleep apnea – undiagnosed
- Aspergillosis
- Chronic Fatigue Syndrome

Clinical Features in Differentiating COPD from Asthma

Clinical Feature	COPD	Asthma
Age	Older than 35 years	Any age
Cough	Persistent, productive	Intermittent, usually nonproductive
Smoking	Typical	Variable
Dyspnea	Progressive, persistent	Variable
Nocturnal symptoms	Breathlessness, late in disease	Coughing, wheezing

Adapted with permission from Stephens, 2008

Clinical Features in Differentiating COPD from Asthma (continued)

Clinical Feature	COPD	Asthma
Family history	Less common	More common
Atopy	Less common	More common
Diurnal symptoms	Less common	More common
Spirometry	Irreversible airway limitation	Reversible airway limitation

Adapted with permission from Stephens, 2008

Diagnostic Criteria

Heart Failure (HF)

Characteristics	Midlife to late-life onset; associated with risk factors such as hypertension and coronary artery disease
Clinical presentation	Fatigue, exertional and paroxysmal nocturnal dyspnea, and peripheral edema, crackles on auscultation
Pulmonary function test	Decreased DLCO, predominantly used to exclude other diagnoses

Adapted with permission from DeWar, 2006
Continued on next slide

Diagnostic Criteria

Heart Failure (HF, continued)

Chest radiography	Increased heart size, pulmonary vascular congestion, pleural effusions
Other recommended testing	Echocardiography, BNP measurement, electrocardiography; cardiac catheterization in selected patients

Adapted with permission from DeWar, 2006
Continued on next slide

Diagnostic Criteria

Tuberculosis (continued)

Chest radiography	Infiltrate, nodular lesions, hilar adenopathy, cavitary lesions or granulomas
Other recommended testing	Sputum AFB culture, PPD, sputum cultures confirm diagnosis

Adapted with permission from DeWar, 2006
Continued on next slide

COPD Leads to Cor Pulmonale



What is Cor Pulmonale in the COPD Patient?

- The progress of COPD results in right sided heart failure. The right ventricle has become hypertrophied and dilated and its function has become compromised due to pulmonary hypertension associated with COPD.

Pathway of COPD to Cor Pulmonale

- COPD is the most common cause of Cor Pulmonale.
- A chronic increase in pulmonary vascular resistance causes the right ventricle to distend and undergo hypertrophy. When the right ventricle can no longer compensate, it causes an increase in the right ventricular end-diastolic pressure and the right atrial pressure; causing right heart failure known as Cor Pulmonale.
- Cor Pulmonale is a maladaptive response to pulmonary hypertension.

(Up to Date, 2012)

COPD to COR Pulmonale

- The chronic inflammation and hypoventilation causes the pulmonary vasoconstriction and signals the kidney to release erythropoietin in response to the low oxygen levels.
- This in turn stimulates the bone marrow to produce reticulocytes which are released into the bloodstream to become erythrocytes.
- Because of the chronic low oxygen levels this process is continually occurring causing an excess of red blood cells (polycythemia).

COPD to Cor Pulmonale

- The progression of COPD results in chronic hypoxic pulmonary vasoconstriction, polycythemia, impaired gas exchange secondary to mucus overproduction and air trapping which destroys the pulmonary vascular bed because of decreased oxygen supply.
- The progression leads to pulmonary hypertension; which puts a stress on the right ventricle causing it to distend and hypertrophy.
- Hypertrophy to the right ventricle is known as Cor Pulmonale.

Clinical Presentation of the Cor Pulmonale Patient

- Most of the symptoms of Cor Pulmonale are not often recognized because the symptoms of COPD are similar and can be overlooked. The symptoms of Cor Pulmonale are: increased weakness, dyspnea, and fatigue.
- The clinical exam is very important in detecting these subtle findings.

Lets look at the clinical exam.

Clinical Examination of Patient

- The patient has jugular venous distension.
- Bilateral lower extremity pitting edema.
- The patient uses home oxygen at 2L/nasal cannula at bedtime.
- The patients resting pulse oximeter reading is 90% on room air.
- A holosystolic murmur at the left lower sternal border characteristic of tricuspid insufficiency.
- Right upper quadrant discomfort upon palpation.
- The patient complains of exertional dyspnea and fatigue despite use of Albuterol inhaler and Pulmicort inhaler.

Why does
the patient have jugular vein distention,
peripheral edema, and right upper quadrant
discomfort?

- Cor Pulmonale patients have pulmonary hypertension which strains the right ventricle of the heart. Pulmonary hypertension causes right sided heart failure and is characterized by:
 1. Jugular vein distension
 2. Peripheral edema of legs and ankle
 3. Right upper quadrant pain from hepatic congestion (hepatomegaly)

(Up to Date, 2012)

Why do we hear a holosystolic murmur?

- The increased intensity of the S2 heart sound (the split second heart sound) is a secondary effect of pulmonary hypertension.
- The tricuspid valve insufficiency is caused by a regurgitation of blood because of pulmonary hypertension.

(Klabunde, 2011)

Pemeriksaan Fisik

Bibir sianosis

JVP meningkat

Paru –Paru

A: RBH dikedua basal

Abdomen

Hepatomegali,

Ekstr ats : Clubing
finger

Eksrt bwh : Oedem
kedua

tungkai

Thorak empisematus

COR:

P : Sternal lift

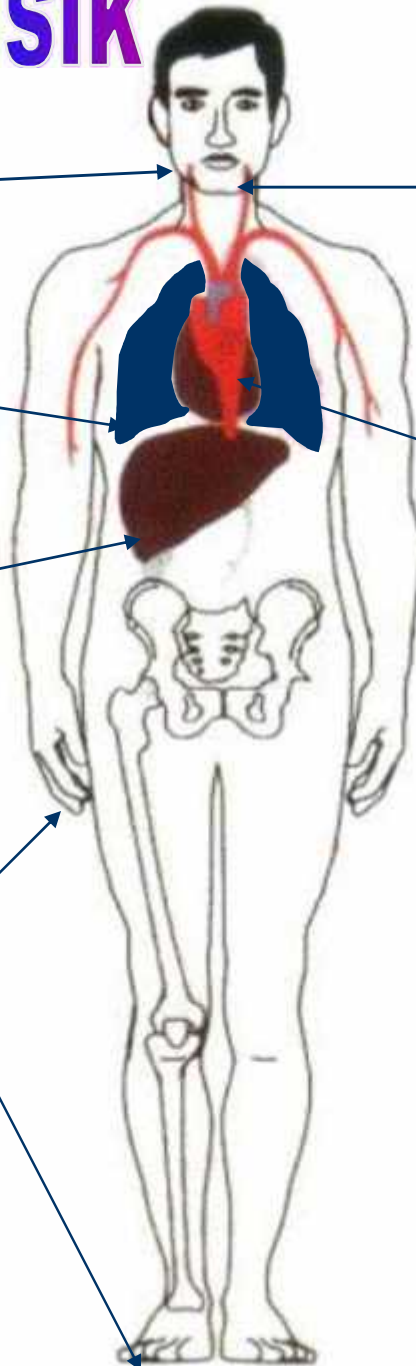
Pulsasi parasternal

Pulsasi epigastrial

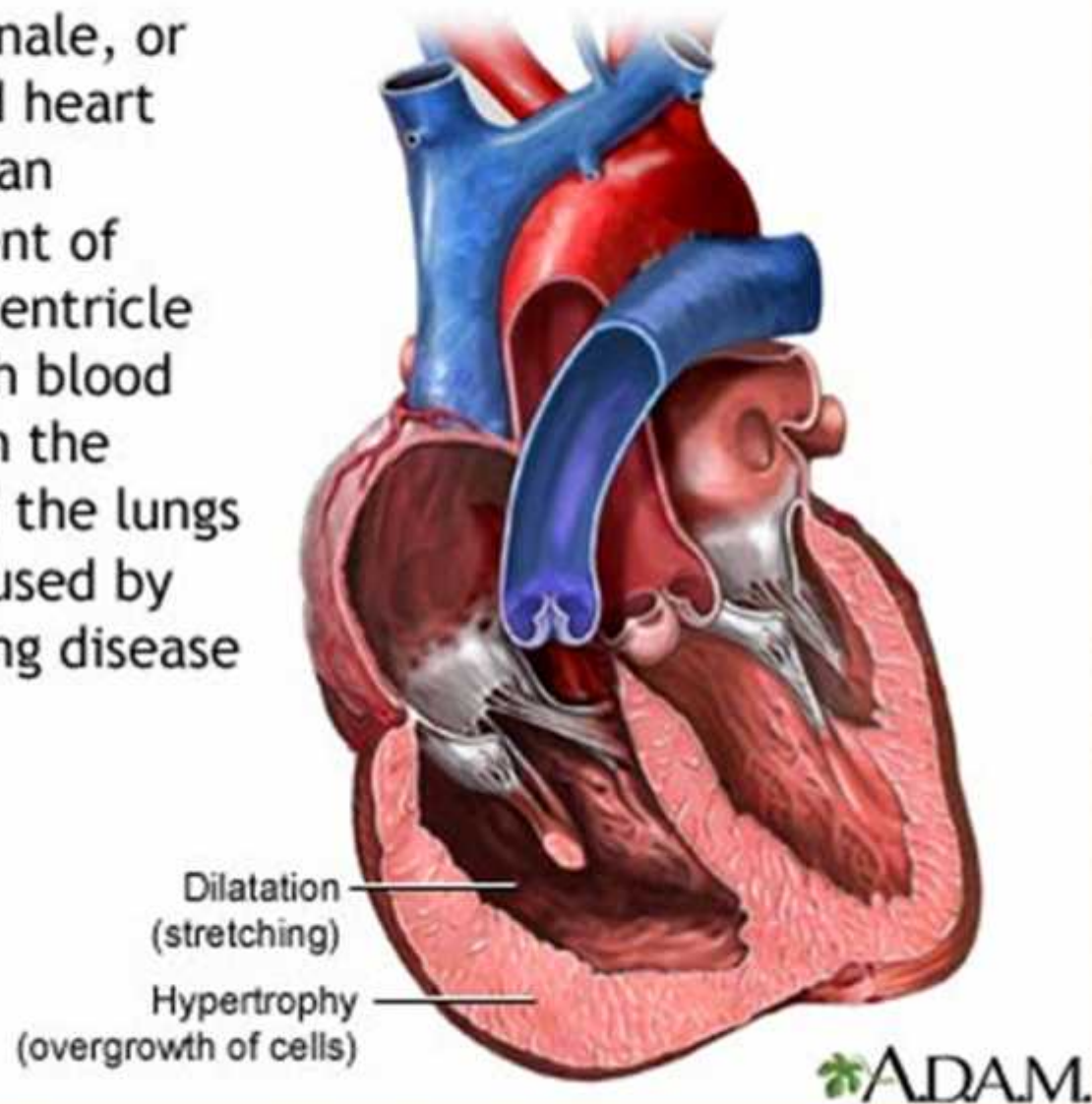
P : RVH

A : Suara jvtung jauh

P2 mengeras, HR \uparrow



Cor pulmonale, or right-sided heart failure, is an enlargement of the right ventricle due to high blood pressure in the arteries of the lungs usually caused by chronic lung disease



Diagnostic Tests for the Cor Pulmonale Patient

1. Chest Radiograph (CXR)
2. Electrocardiogram (EKG)
3. Echocardiogram (ECHO)
4. Pulmonary Function Test (PFT)

Chest Radiograph

The radiograph would show an enlarged pulmonary artery due to pulmonary hypertension. The lateral view would show a loss of retrosternal air space due to the enlargement of the right ventricle.

(Up to Date, 2012)

Chest Radiograph

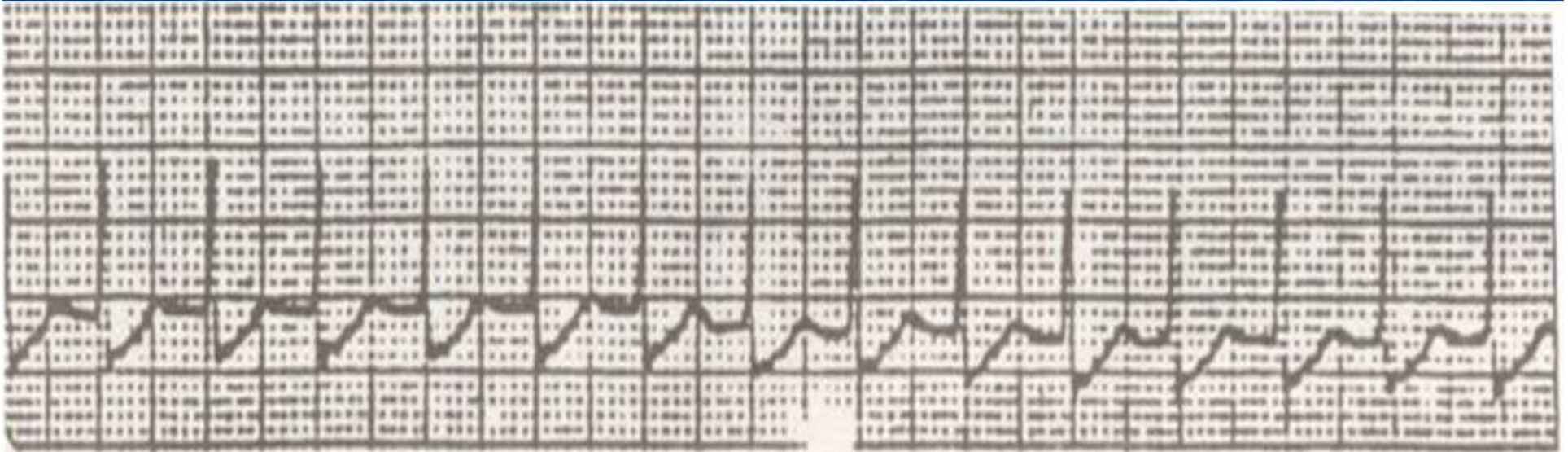


Electrocardiogram

The EKG would possibly show a right bundle branch block and right axis deviation because of the right ventricle hypertrophy and atrial enlargement. There will be dominant R waves in V1 and V2 and prominent S waves in V5 and V6 because of right ventricular hypertrophy. Increased P wave amplitude in Lead II due to right atrial enlargement.

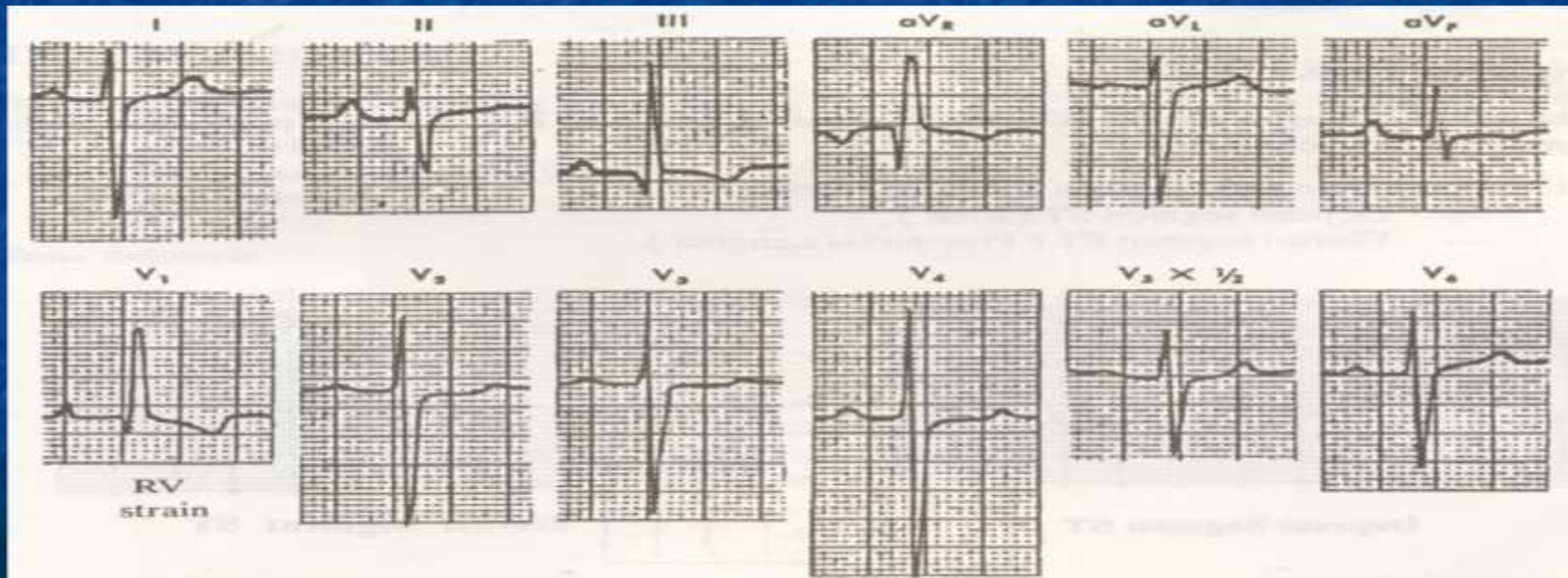
(Up to Date, 2012)

EKG



Hipoksemia : Sinus takikardi

- Hipertropi Ventrikel kanan :
- § Aksis bergeser ke kanan (RAD)
- § Gelombang P yang tinggi
- § Rasio R/S di V1 > 1
- § Rasio R/S di V6 < 1
- § Gelombang S yang dalam di V5 dan V6
- § RBBB incomplet atau complet



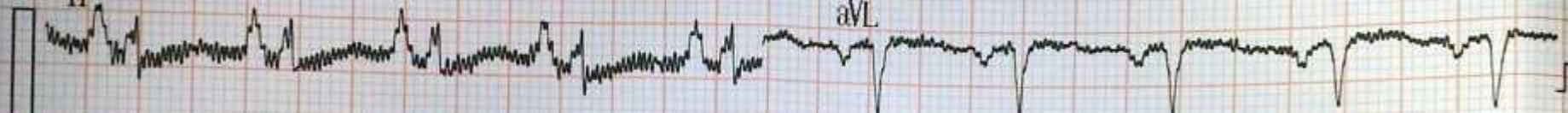
Dec-15-2008 11:12:46

ID: 0
aVR



II

aVL



x1 III

aVF



FUKUDA DENSHI UF-1181E LOT NO. 0809

HR: 105

V1

V4



V2

V5



V3

V6



x 1/4

10,

12,

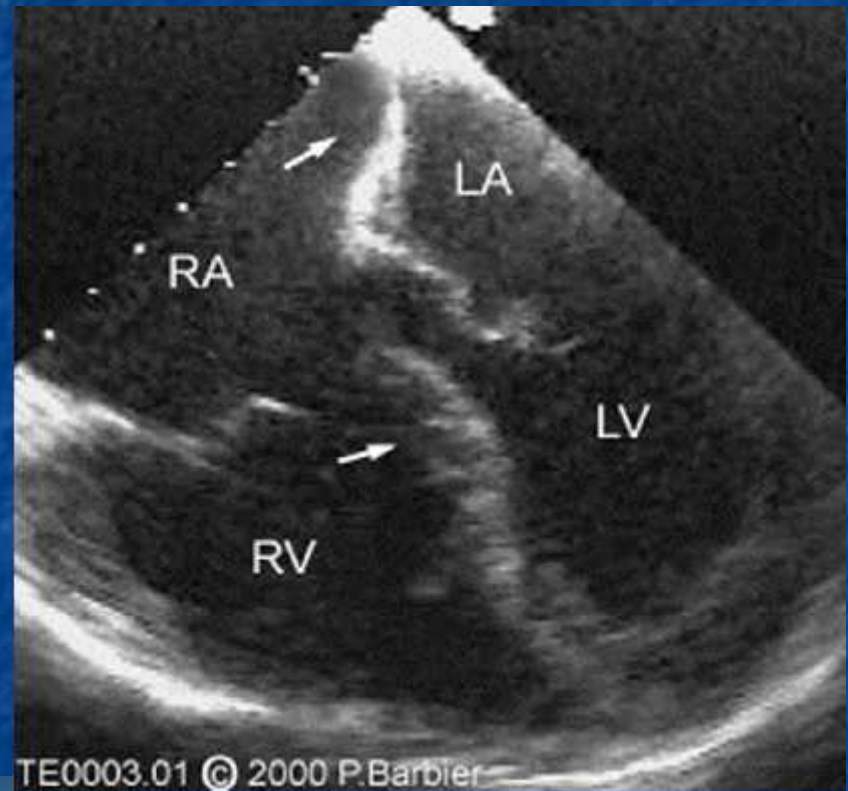
FX-7102-V01-03-S1

Echocardiogram

The echocardiogram will show right ventricular hypertrophy, right ventricular dilation and tricuspid regurgitation due to right atrial enlargement.

(Up to Date, 2012)

● Ekokardiografi



- Dimensi ventrikel kanan membesar
- Struktur dan dimensi ventrikel kiri normal
- Gelombang 'a' hilang

Pulmonary Function Test

The pulmonary function test will indicate an impaired diffusion capacity due to the acidotic pH. It may also show a restrictive ventilatory defect.

(Up to Date, 2012)

Right Heart Catheterization

- This is considered the gold standard for Cor Pulmonale Diagnosis.
- The patient who presents with chest pain and has nondiagnostic or normal results of the chest radiograph, echocardiogram, EKG, and pulmonary function tests will have a right heart catheterization done to confirm the diagnosis.

(Up to Date, 2012)

Review

- What diagnostic tests do you order to confirm the Cor Pulmonale diagnosis?

Stress test, CXR,
and echo.
No! this may be
ordered to confirm
CHF diagnosis.

Chest radiograph,
EKG, Echo and PFT.
Yes !

CXR, ABG's and
sputum specimen.
Try again!
This may be used to
diagnose a lung
infection.

3 Major Physiological Goals of Cor Pulmonale Treatment

- 1. Reduce the right ventricular after load causing a reduction of the pulmonary artery pressure.
- 2. Decrease right ventricular pressure.
- 3. Improve the contractility of the right ventricle.

Treatment of Patients with Cor Pulmonale

- Oxygen therapy for patients with hypoxemia. The oxygen will improve hypoxic vasoconstriction. Oxygen also may improve pulmonary artery pressure and pulmonary vascular resistance and polycythemia associated with hypoxia.

(Up to Date,2012)

Treatment (cont.)

- Diuretic therapy to improve right ventricular function due to increased right ventricular pressures.
- Diuretics must be used carefully because cor pulmonale patients are preload dependent and an under filling of the right ventricle may decrease the stroke volume and increase their symptoms.
- The diuretics may also increase the patients risk of developing arrhythmias and metabolic acidosis because of the loss of potassium from the diuretics.

(Up to Date, 2012)

Treatment (cont.)

- Inotropic agents are used to increase the right ventricle contractility and decrease the right ventricle afterload by inducing pulmonary vasodilation.

(Up to Date,2012)

Conclusion

- What are the 3 major physiological goals we carry out when treating a patient with Cor Pulmonale?

Reduce right ventricular afterload.

Yes! That is one!

Decrease right ventricular pressure.

Yes! That is two!

Improve the contractility of the right ventricle.

Yes! That is three!

COPD to Cor Pulmonale

- COPD is the fourth leading cause of death in the United States. COPD leads to Cor Pulmonale. Nurse Practitioners will be expected to manage the treatment of patients with Cor Pulmonale.. The management of Cor Pulmonale will focus on the extent of the lung disease and heart failure of the patient.

Tanjimasth

